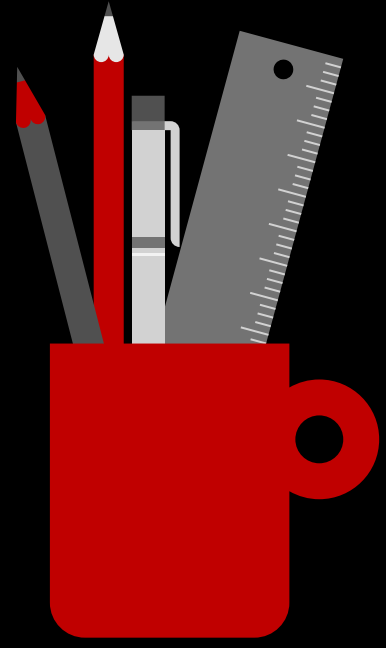


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# What is Quadratic Equation

A second degree equation in variable  $x$  in the form

$$ax^2 + bx + c = 0$$

$$a, b, c \in \mathbb{R}$$



What is pure quadratic equation?

$$ax^2 + bx + c = 0$$

If  $b = 0$

$$ax^2 + 0(x) + c = 0$$

$$ax^2 + c = 0$$

pure quadratic equation



Methods to solve Quadratic

Equation

i) Factorization

ii) Completing The

Square

iii) Quadratic formula.



## Ex. 1.1

①

$$i) (x+7)(x-3) = -7$$

$$x^2 - 3x + 7x - 21 + 7 = 0$$

$$x^2 + 4x - 14 = 0$$

Quadratic Equation



(iv) ~~(x)~~ ii)  $\frac{x^2+4}{3} - \frac{x}{7} = 1$

$$\cancel{21} \times \frac{x^2+4}{\cancel{3}} - \frac{x \times \cancel{21}^3}{\cancel{7}} = 1 \times 21$$

$$\begin{array}{r|l} 3 & 3-7 \\ \hline 7 & 1-7 \\ \hline & 1-1 \end{array}$$

$$7x^2 + 28 - 3x = 21$$

$$7x^2 - 3x + 28 - 21 = 0$$

$$7x^2 - 3x + 7 = 0$$

Quadratic





$$\text{iii) } \frac{x}{x+1} + \frac{x+1}{x} = 6$$

$$\frac{x^2 + (x+1)^2}{x(x+1)} = 6$$

$$x(x+1)$$

$$x^2 + x^2 + 1 + 2x = 6x(x+1)$$

$$2x^2 + 2x + 1 = 6x^2 + 6x$$

$$2x^2 + 2x + 1 - 6x^2 - 6x = 0$$

$$\Rightarrow -4x^2 - 4x + 1 = 0 \quad \text{quadratic}$$



$$\text{iv) } \frac{x+4}{x-2} - \frac{x-2}{x} + \frac{4}{1} = 0$$

$$\underline{x(x+4) - (x-2)^2 + 4x(x-2) = 0}$$

$$x(x-2)$$

$$x^2 + 4x - (x^2 + 4 - 4x) + 4x^2 - 8x = 0 \times x(x-2)$$

$$x^2 + 4x - x^2 - 4 + 4x + 4x^2 - 8x = 0$$

$$4x^2 + 8x - 8x - 4 = 0$$

$$ax^2 + bx + c = 0$$

$$4x^2 - 4 = 0$$

$$\text{Pure Quadratic } ax^2 + c = 0$$







$$v) \frac{x+3}{x+4} - \frac{x-5}{x} = 1$$

$$\frac{x(x+3) - (x-5)(x+4)}{x(x+4)} = 1$$

$$x^2 + 3x - (x^2 + 4x - 5x - 20) = 1 \times x(x+4)$$

$$x^2 + 3x - (x^2 - x - 20) = x^2 + 4x$$

$$\cancel{x^2} + 3x - \cancel{x^2} + x + 20 - x^2 - 4x = 0$$

$$-x^2 + 4x - 4x + 20 = 0$$

$$-x^2 + 20 = 0$$

Pure quadratic



$$vi) \frac{x+1}{x+2} + \frac{x+2}{x+3} = \frac{25}{12}$$

$$\frac{(x+3)(x+1) + (x+2)^2}{(x+2)(x+3)} = \frac{25}{12}$$

$$\frac{(x^2 + x + 3x + 3) + (x^2 + 2^2 + 2(x)(2))}{x^2 + 3x + 2x + 6} = \frac{25}{12}$$

$$\frac{(x^2 + 4x + 3) + (x^2 + 4 + 4x)}{x^2 + 5x + 6} = \frac{25}{12}$$

$$\frac{2x^2 + 8x + 7}{x^2 + 5x + 6} = \frac{25}{12}$$

$$24x^2 + 96x + 84 = 25x^2 + 125x + 150$$

$$25x^2 + 125x + 150 - 24x^2 - 96x - 84 = 0$$

$$x^2 + 29x + 66 = 0$$

quadratic



② Solve by factorization.

$$x^2 - x - 20 = 0$$

$$\underline{x^2 - 5x + 4x - 20 = 0}$$

$$x(x-5) + 4(x-5) = 0$$

$$(x-5)(x+4) = 0$$

$$x-5 = 0, \quad x+4 = 0$$

$$x = 5 \quad | \quad x = -4$$

$$\begin{array}{r} \checkmark -20x^2 \\ 1 \quad \quad \quad 20x \\ 2 \quad \quad \quad 10x \\ 4 \quad \quad \quad 5 \checkmark \end{array}$$

$$\text{S.S } \{ \underline{\underline{5, -4}} \}$$



$$2) \text{ ii) } 3y^2 = y(y-5)$$

$$3y^2 = y^2 - 5y$$

$$3y^2 - y^2 + 5y = 0$$

$$2y^2 + 5y = 0$$

$$y(2y + 5) = 0$$

$$y = 0 \quad \vee \quad 2y + 5 = 0$$

$$2y = -5$$
$$y = -\frac{5}{2}$$

S.S }  $0, -\frac{5}{2}$





$$2) \text{ iii) } 4 - 32x = 17x^2$$

$$17x^2 + 32x - 4 = 0$$

$$17x^2 + 34x - 2x - 4 = 0$$

$$17x(x+2) - 2(x+2) = 0$$

$$(x+2)(17x-2) = 0$$

$$x+2 = 0$$

$$x = -2$$

$$17x - 2 = 0$$

$$17x = 2$$

$$x = \frac{2}{17}$$

$$-68x^2$$

$$1 \quad 68x$$

$$2 \quad 34 \checkmark$$

$$\text{s.s } \left\{ -2, \frac{2}{17} \right\}$$





$$2) \text{ iv) } x^2 - 11x = 152$$

$$x^2 - 11x - 152 = 0$$

$$\underline{x^2 - 19x} + \underline{8x - 152} = 0$$

$$x(x-19) + 8(x-19) = 0$$

$$(x-19)(x+8) = 0$$

$$x-19 = 0 \quad \text{,} \quad x+8 = 0$$

$$x = 19 \quad \text{,} \quad x = -8$$

S.S } 19, -8

$$-152 \quad x^2$$

$$1 \quad 152x$$

$$2 \quad 76x$$

$$3 \quad 4x$$

$$4 \quad 38x$$

$$8 \quad 19 \checkmark$$



$$2) \frac{x+1}{x} + \frac{x}{x+1} = \frac{25}{12}$$

$$\frac{(x+1)^2 + x^2}{x(x+1)} = \frac{25}{12}$$

$$\frac{x^2 + 1 + 2x + x^2}{x^2 + x} = \frac{25}{12}$$

$$\frac{2x^2 + 2x + 1}{x^2 + x} = \frac{25}{12}$$

$$24x^2 + 24x + 12 = 25x^2 + 25x$$

$$25x^2 + 25x - 24x^2 - 24x - 12 = 0$$

$$x^2 + x - 12 = 0$$

$$x^2 + 4x - 3x - 12 = 0 - 12$$

$$x(x+4) - 3(x+4) = 0$$

$$(x+4)(x-3) = 0$$

$$x+4 = 0, x-3 = 0$$

$$x = -4, x = 3$$

$$S.S \{ -4, 3 \}$$



$$2) \frac{2}{x-9} = \frac{1}{x-3} - \frac{1}{x-4}$$

$$\frac{2}{x-9} = \frac{x-4 - (x-3)}{(x-3)(x-4)}$$

$$\frac{2}{x-9} = \frac{x-4-x+3}{(x-3)(x-4)}$$

~~$$\frac{2}{x-9} = \frac{-1}{(x-3)(x-4)}$$~~

$$2(x-3)(x-4) = -x+9$$

$$2(x^2 - 4x - 3x + 12) = -x + 9$$

$$2(x^2 - 7x + 12) = -x + 9$$

$$2x^2 - 14x + 24 + x - 9 = 0$$

$$2x^2 - 13x + 15 = 0$$

$$2x^2 - 10x - 3x + 15 = 0 \quad \left| \begin{array}{l} + 30x^2 \\ 1 \quad 30x \\ 2 \quad 15x \\ 3 \quad 10 \end{array} \right.$$

$$2x(x-5) - 3(x-5) = 0$$

$$(x-5)(2x-3) = 0$$

$$x-5 = 0$$

$$x = 5$$

$$2x = 3$$

$$x = \frac{3}{2}$$

$$\text{S.S } \left\{ 5, \frac{3}{2} \right\}$$





3) Solve by completing square.

$$1) 7x^2 + 2x - 1 = 0$$

$$7x^2 + 2x = 1$$

$$\frac{7x^2}{7} + \frac{2x}{7} = \frac{1}{7}$$

$$x^2 + \frac{2}{7}x = \frac{1}{7}$$

$$(x)^2 + 2(x)\left(\frac{1}{7}\right) + \left(\frac{1}{7}\right)^2 = \frac{1}{7} + \left(\frac{1}{7}\right)^2$$

$$\left(x + \frac{1}{7}\right)^2 = \frac{1}{7} + \frac{1}{49}$$

$$\left(x + \frac{1}{7}\right)^2 = \frac{7+1}{49}$$

$$x = \frac{-1 \pm 2\sqrt{2}}{7}$$

S.S.  $\left\{ \frac{-1 \pm 2\sqrt{2}}{7} \right\}$

$$(a+b)^2 = a^2 + b^2 + 2ab$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$\sqrt{\left(x + \frac{1}{7}\right)^2} = \sqrt{\frac{8}{49}}$$

$$x + \frac{1}{7} = \pm \frac{\sqrt{8}}{7}$$

$$x = -\frac{1}{7} \pm \frac{\sqrt{4 \times 2}}{7}$$

$$x = -\frac{1}{7} \pm \frac{2\sqrt{2}}{7}$$

$$x = \frac{-1 \pm 2\sqrt{2}}{7}$$

$$\textcircled{3} \text{ii) } ax^2 + 4x - a = 0$$

$$ax^2 + 4x = a$$

$$\frac{ax^2}{a} + \frac{4}{a}x = \frac{a}{a} \quad \left| \frac{4^2}{a \times x} \right.$$

$$x^2 + \frac{4}{a}x = 1$$

$$\left(x\right)^2 + 2\left(x\right)\left(\frac{2}{a}\right) + \left(\frac{2}{a}\right)^2 = 1 + \left(\frac{2}{a}\right)^2$$

$$\left(x + \frac{2}{a}\right)^2 = 1 + \frac{4}{a^2}$$

$$\left(x + \frac{2}{a}\right)^2 = \frac{a^2 + 4}{a^2}$$

$$\left(x + \frac{2}{a}\right)^2 = \sqrt{\frac{a^2 + 4}{a^2}}$$

$$x + \frac{2}{a} = \pm \frac{\sqrt{a^2 + 4}}{a}$$

$$x = \frac{-2 \pm \sqrt{a^2 + 4}}{a}$$

$$x = \frac{-2 \pm \sqrt{a^2 + 4}}{a}$$

$$\text{S.S } \left\{ \frac{-2 \pm \sqrt{a^2 + 4}}{a} \right\}$$

Ans



$$(3) \text{ iii) } 11x^2 - 34x + 3 = 0$$

$$11x^2 - 34x = -3$$

$$\frac{11x^2}{11} - \frac{34x}{11} = \frac{-3}{11}$$

$$x^2 - \frac{34}{11}x = \frac{-3}{11}$$

$$(x)^2 - 2(x)\left(\frac{17}{11}\right) + \left(\frac{17}{11}\right)^2 = \frac{-3}{11} + \left(\frac{17}{11}\right)^2$$

$$\left(x - \frac{17}{11}\right)^2 = \frac{-3}{11} + \frac{289}{121}$$

$$\left(x - \frac{17}{11}\right)^2 = \frac{-33 + 289}{121}$$

$$\sqrt{\left(x - \frac{17}{11}\right)^2} = \sqrt{\frac{256}{121}}$$

$$x - \frac{17}{11} = \pm \frac{16}{11}$$

$$x = \frac{17}{11} \pm \frac{16}{11}$$

$$x = \frac{17}{11} + \frac{16}{11}$$

$$x = \frac{17+16}{11}$$

$$x = \frac{33}{11}$$

$$x = 3$$

$$x = \frac{17}{11} - \frac{16}{11}$$

$$x = \frac{17-16}{11}$$

$$x = \frac{1}{11}$$

$$x = 3 \quad \text{S.S.} \left\{ 3, \frac{1}{11} \right\} =$$



$$\text{iv) } lx^2 + mx + n = 0, \quad l \neq 0$$
$$lx^2 + mx = -n$$

$$\frac{lx^2}{l} + \frac{mx}{l} = \frac{-n}{l}$$

$$x^2 + \frac{m}{l}x = \frac{-n}{l}$$

$$\left(x\right)^2 + 2\left(x\right)\left(\frac{m}{2l}\right) + \left(\frac{m}{2l}\right)^2 = \frac{-n}{l} + \left(\frac{m}{2l}\right)^2$$

$$\left(x + \frac{m}{2l}\right)^2 = \frac{-n}{l} + \frac{m^2}{4l^2}$$

$$\left(x + \frac{m}{2l}\right)^2 = \frac{-4ln + m^2}{4l^2}$$

$$\sqrt{\left(x + \frac{m}{2l}\right)^2} = \sqrt{\frac{m^2 - 4ln}{4l^2}}$$

$$\left(x + \frac{m}{2l}\right) = \pm \frac{\sqrt{m^2 - 4ln}}{2l}$$

$$x = \frac{-m}{2l} \pm \frac{\sqrt{m^2 - 4ln}}{2l}$$

$$x = \frac{-m \pm \sqrt{m^2 - 4ln}}{2l}$$

S.S

$$\left. \frac{-m \pm \sqrt{m^2 - 4ln}}{2l} \right\}$$

Ans



$$(3) \textcircled{v} \quad 3x^2 + 7x = 0$$

$$\cancel{3}x^2 + \frac{7}{\cancel{3}}x = \frac{0}{3}$$

$$x^2 + \frac{7}{3}x = 0$$

$$(x)^2 + 2(x)\left(\frac{7}{6}\right) + \left(\frac{7}{6}\right)^2 = 0 + \left(\frac{7}{6}\right)^2$$

$$\sqrt{\left(x + \frac{7}{6}\right)^2} = \sqrt{\frac{49}{36}}$$

$$x + \frac{7}{6} = \pm \frac{7}{6}$$

$$x = -\frac{7}{6} \pm \frac{7}{6}$$

$$x = \frac{-7}{6} + \frac{7}{6} \quad \left| \quad x = \frac{-7}{6} - \frac{7}{6}\right.$$

$$x = 0$$

$$x = \frac{-7-7}{6}$$

$$x = \frac{-14}{6} = \frac{-7}{3}$$

$$\text{S.S } \left\{ 0, -\frac{7}{3} \right\}$$

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$$3) \text{ vi) } x^2 - 2x - 195 = 0$$

$$x^2 - 2x = 195$$

$$(x)^2 - 2(x)(1) + (1)^2 = 195 + (1)^2$$

$$(x-1)^2 = 195+1$$

$$\sqrt{(x-1)^2} = \sqrt{196}$$

$$x-1 = \pm 14$$

$$x-1 = 14, \quad x-1 = -14$$

$$x = 14+1 \quad | \quad x = -14+1$$
$$x = 15 \quad | \quad x = -13$$

$$\text{S.S } \{15, -13\}$$

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$$\text{vii) } -x^2 + \frac{15}{2} = \frac{7}{2}x$$

$$-x^2 - \frac{7}{2}x = -\frac{15}{2}$$

$$x^2 + \frac{7}{2}x = \frac{15}{2}$$

$$x^2 + \frac{7}{2}x = \frac{15}{2}$$

$$(x)^2 + 2(x)\left(\frac{7}{4}\right) + \left(\frac{7}{4}\right)^2 = \frac{15}{2} + \left(\frac{7}{4}\right)^2$$

$$\left(x + \frac{7}{4}\right)^2 = \frac{15}{2} + \frac{49}{16}$$

$$\left(x + \frac{7}{4}\right)^2 = \frac{120 + 49}{16}$$

$$\sqrt{\left(x + \frac{7}{4}\right)^2} = \sqrt{\frac{169}{16}}$$

$$x + \frac{7}{4} = \pm \frac{13}{4}$$

$$x = -\frac{7}{4} \pm \frac{13}{4}$$

$$x = -\frac{7}{4} + \frac{13}{4}$$

$$x = \frac{-7+13}{4}$$

$$x = \frac{3}{4}$$

$$x = \frac{3}{2}$$

$$x = \frac{-7}{4} - \frac{13}{4}$$

$$x = \frac{-7-13}{4}$$

$$x = -\frac{20}{4}$$

$$x = -5$$

$$SS \left\{ \frac{3}{2}, -5 \right\}$$



$$3) \text{viii) } x^2 + 17x + 33 = 0$$

$$x^2 + 17x = -\frac{33}{4}$$

$$\left(x\right)^2 + 2\left(x\right)\left(\frac{17}{2}\right) + \left(\frac{17}{2}\right)^2 = -\frac{33}{4} + \left(\frac{17}{2}\right)^2$$

$$\left(x + \frac{17}{2}\right)^2 = -\frac{33}{4} + \frac{289}{4}$$

$$\left(x + \frac{17}{2}\right)^2 = \frac{-33 + 289}{4}$$

$$\left(x + \frac{17}{2}\right)^2 = \sqrt{\frac{256}{4}}$$

$$x + \frac{17}{2} = \pm \frac{16}{2}$$

$$x + \frac{17}{2} = \pm \frac{16}{2}$$

$$x = \frac{-17}{2} \pm \frac{16}{2}$$

$$x = \frac{-17 + 16}{2} \quad \left| \quad x = \frac{-17 - 16}{2}\right.$$

$$x = \frac{-17 + 16}{2} \quad \left| \quad x = \frac{-17 - 16}{2}\right.$$

$$x = \frac{-1}{2} \quad \left| \quad x = \frac{-33}{2}\right.$$

$$\text{S.S } \left\{ -\frac{1}{2}, -\frac{33}{2} \right\}$$





$$\text{ix) } 4 - \frac{8}{3x+1} = \frac{3x^2+5}{3x+1}$$

$$\frac{3x^2+5}{3x+1} + \frac{8}{3x+1} = 4$$

$$\frac{3x^2+5+8}{3x+1} = 4$$

$$\frac{3x^2+13}{3x+1} = \frac{4}{1}$$

$$3x^2+13 = 12x+4$$

$$3x^2-12x = 4-13$$

$$3x^2-12x = -9$$

$$\frac{3x^2}{3} - \frac{12x}{3} = -\frac{9}{3}$$

$$x^2 - 4x = -3$$

$$(x)^2 - 2(x)(2) + (2)^2 = -3 + (2)^2$$

$$(x-2)^2 = -3+4$$

$$(x-2)^2 = 1$$

$$\sqrt{(x-2)^2} = \sqrt{1}$$

$$x-2 = \pm 1$$

$$x-2 = 1$$

$$x = 1+2$$

$$x = 3$$

$$x-2 = -1$$

$$x = -1+2$$

$$x = 1$$

$$\text{s.s } \{3, 1\} =$$



$$3) x) \quad 7(x+2a)^2 + 3a^2 = 5a(7x+23a) \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{SS} \{4a, -3a\}$$

$$7(x^2 + 4a^2 + 4ax) + 3a^2 = 35ax + 115a^2$$

$$7x^2 + 28a^2 + 28ax + 3a^2 - 35ax - 115a^2 = 0$$

$$7x^2 - 7ax - 84a^2 = 0$$

$$7(x^2 - ax - 12a^2) = 0$$

$$x^2 - ax - 12a^2 = 0$$

$$x^2 - ax = 12a^2$$

$$(x)^2 - 2(x)\left(\frac{a}{2}\right) + \left(\frac{a}{2}\right)^2 = 12a^2 + \left(\frac{a}{2}\right)^2$$

$$\left(x - \frac{a}{2}\right)^2 = \frac{12a^2}{1} + \frac{a^2}{4}$$

$$\left(x - \frac{a}{2}\right)^2 = \frac{48a^2 + a^2}{4}$$

$$\sqrt{\left(x - \frac{a}{2}\right)^2} = \sqrt{\frac{49a^2}{4}}$$

$$x - \frac{a}{2} = \pm \frac{7a}{2}$$

$$x - \frac{a}{2} = \frac{7a}{2}$$

$$x = \frac{7a}{2} + \frac{a}{2}$$

$$x = \frac{8a}{2}$$

$$x = 4a$$

$$x - \frac{a}{2} = -\frac{7a}{2}$$

$$x = -\frac{7a}{2} + \frac{a}{2}$$

$$x = \frac{-6a}{2}$$

$$x = -3a$$